



# **MEDICAL AND DENTAL COLLEGES ADMISSION TEST (MDCAT)**

## **CURRICULUM 2025**

**(Biology, Chemistry, Physics, English and Logical Reasoning)**

**(DRAFT)**

## BIOLOGY

UNIT	No.	STUDENT LEARNING OUTCOME
1- ACELLULAR LIFE	1.1	Classify viruses on basis of their structure/ number of strands/ diseases/ host etc.
	1.2	Identify symptoms, mode of transmission and cause of viral disease (AIDS).
2- BIOENERGETICS	2.1	Explain the process of photosynthesis.
	2.2	Explain the role of factors (light, water, CO <sub>2</sub> ) affecting photosynthesis.
	2.3	Explain light dependent and independent phases/reaction.
3- BIOLOGICAL MOLECULES	3.1	Define and classify biological molecules.
	3.2	Discuss the importance of biological molecules.
	3.3	Describe biologically important properties of water (polarity, hydrolysis, specific heat, water as solvent and reagent, density, cohesion/ionization).
	3.4	Discuss carbohydrates: monosaccharides (glucose), oligosaccharides (cane sugar, sucrose, lactose), polysaccharides (starches, cellulose, glycogen).
	3.5	Describe proteins: amino acids, structure of proteins.
	3.6	Describe lipids: phospholipids, triglycerides, alcohol and esters (acylglycerol).
	3.7	Give an account of RNA.
	3.8	Discuss conjugated molecules (glycol lipids, glycol proteins).
	4.1	Compare the structure of typical animal and plant cell.
4- CELL STRUCTURE & FUNCTION	4.2	Compare and contrast the structure of prokaryotic cells with eukaryotic cells.
	4.3	Outline the structure and function of the following organelles: nucleus, endoplasmic reticulum, golgi apparatus, mitochondria.
	5.1	Recognize receptors as transducers sensitive to various stimuli.
5- COORDINATION & CONTROL/ NERVOUS & CHEMICAL COORDINATION	5.2	Define neurons.
	5.3	Explain the structure of a typical neuron (cell body, dendrites, axon and myelin sheath and schwann cells).
	5.4	Define nerve impulse.
	5.5	Classify reflexes.
	5.6	Briefly explain the functions of components of a reflex arc.
	5.7	List the main parts of the brain (e.g., components of brain stem, mid brain, cerebellum, cerebrum).

	5.8	Describe the functions of each part of the brain.
6- DIVERSITY AMONG ANIMALS (THE KINGDOM ANIMALIA)	6.1	Describe general characteristic of animals.
7- ENZYMES	7.1	Describe the distinguishing characteristics of enzymes.
	7.2	Explain mechanism of action of enzymes.
	7.3	Describe effects of factor on enzyme action (temperature, pH, concentration).
	7.4	Describe enzyme inhibitors.
8- EVOLUTION	8.1	Explain origin of life according to concept of evolution.
	8.2	Describe the theory of inheritance of acquired characters, as proposed by Lamarck.
	8.3	Explain the theory of natural selection as proposed by Darwin.
9- PROKARYOTES (KINGDOM MONERA)	9.1	Describe cellular structures of bacteria.
	9.2	Explain diversity in shape and size in bacteria.
	9.3	Highlight the importance of bacteria and control of harmful bacteria.
10- REPRODUCTION	10.1	Describe the functions of various parts of the male & female reproductive systems and the hormones that regulate those functions.
	10.2	Describe the menstrual cycle (female reproductive cycle) emphasizing the role of hormones.
	10.3	List the common sexually transmitted diseases along with their causative agents and main symptoms.
11- SUPPORT & MOVEMENT	11.1	Define cartilage, muscle and bone.
	11.2	Explain the main characteristics of cartilage and bone along with functions.
	11.3	Compare characteristics of smooth muscles, cardiac muscles and skeletal muscles.
	11.4	Explain the ultra-structure of skeletal muscles.
	11.5	Describe in brief the process of skeletal muscle contraction.
	11.6	Classify joints.
	11.7	Define arthritis.
12- INHERITANCE	12.1	Associate inheritance with the laws of Mendel.
	12.2	Explain the law of independent assortment, using a suitable example.
	12.3	Describe the terms gene linkage and crossing over.

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	12.4	Explain how gene linkage counters independent assortment and crossing-over modifies the progeny.
	12.5	Describe the concept of sex-linkage.
	12.6	Briefly describe Inheritance of sex-linked traits.
	12.7	Analyze the inheritance of hemophilia.
13- Form and Function in Plants	13.1	Discuss the examples of carnivorous plants (pitcher plant, venus fly trap and sundew).
	13.2	Describe osmotic pressure and its importance in plants.
	13.3	Describe water and minerals uptake by roots, xylem and phloem.
	13.4	Explain the functions of hormones naturally produced by plants.
14- Circulation	14.1	List general structure of human heart.
	14.2	Define the phases of heart beat.
	14.3	List the differences and functions of arteries, veins and capillaries.
	14.4	Describe lymphatic system (nodes, vessels and organs)
15- Immunity	15.1	Define and discuss the functions and importance of specific defense mechanisms.
16- Respiration	16.1	Discuss the functions of main part of respiratory system.
	16.2	Discuss the process of gaseous exchange in human lungs.
	16.3	List the effect of smoking on respiratory system.

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# Chemistry

<b>UNIT</b>	<b>No.</b>	<b>STUDENT LEARNING OUTCOME</b>
1- INTRODUCTION OF FUNDAMENTAL CONCEPTS OF CHEMISTRY	1.1	Construct mole ratios from balanced equations for use as conversion factors in stoichiometric problems.
	1.2	Perform stoichiometric calculations with balanced equations using moles, representative particles, masses and volumes of gases (at STP).
	1.3	Explain the limiting reagent in a reaction
	1.4	Calculate the maximum number of product(s) produced and the amount of any un-reacted excess reagent.
	1.5	Given information from which any two of the following may be determined, calculate the third: theoretical yield, actual yield, percentage yield.
	1.6	Calculate the theoretical yield and the percent yield when given the balanced equation, the amounts of reactants and the actual yield
2- ATOMIC STRUCTURE	2.1	Define photon as a unit of radiation energy.
	2.2	Describe the concept of orbitals.
	2.3	Distinguish among principle energy levels, energy sub-levels, and atomic orbitals.
	2.4	Describe the general shapes of s, p, and orbitals.
	2.5	Use the Aufbau Principle, the Pauli Exclusion Principle, and Hund's Rule to write the electronic configuration of the atoms.
	2.6	Write electronic configuration of atoms.
3-GASES	3.1	List the postulates of kinetic molecular theory.
	3.2	Describe the motion of particles of a gas according to kinetic theory.
	3.3	State the values of standard temperature and pressure (STP).
	3.4	Describe the effect of change in pressure on the volume of gas.
	3.5	Describe the effect of change in temperature on the volume of gas.
4- LIQUIDS	4.1	Describe simple properties of liquids e.g. diffusion, compression, expansion, motion of molecules, spaces between them, intermolecular forces and kinetic energy based on kinetic molecular theory.
	4.2	Explain physical properties of liquids such as evaporation, vapor pressure, boiling point.
	4.3	Describe the hydrogen bonding in H <sub>2</sub> O, NH <sub>3</sub> and HF molecules.
	4.4	Anomalous behavior of water when its density shows maximum at 4 degree centigrade
5- SOLIDS	5.1	Describe crystal line solids.
	5.2	Name three factors that affect the shape of an ionic crystal.
	5.3	Give a brief description of ionic and molecular solids.

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	5.4	Describe crystal lattice.
	5.5	Define lattice energy.
6- CHEMICAL EQUILIBIRIUM (6.6 and 6.7 from Acid-Base and Salt Unit)	6.1	Define chemical equilibrium in terms of a reversible reaction.
	6.2	Write both forward and reverse reactions and describe them acroscopic characteristics of each.
	6.3	State Le Chatelier's Principle and be able to apply it to systems in equilibrium with changes in concentration, pressure, temperature, or the addition of catalyst.
	6.4	Define and explain solubility product.
	6.5	Define and explain the common ion effect by giving suitable examples.
	6.6	Describe buffer solutions and explain types of buffers.
	6.7	Explain synthesis of ammonia by Haber's Process.
7- REACTION KINETICS	7.1	Define chemical kinetics.
	7.2	Explain the terms rate of reaction, rate equation, order of reaction, rate constant and rate determining step.
	7.3	Explain qualitatively factors affecting rate of reaction.
	7.4	Given the order with respect to each reactant, write the rate law for the reaction.
	7.5	Explain the meaning of the terms „activation energy“ and activated complex“.
	7.6	Relate the ideas of activation energy and the activated complex to the rate of a reaction.
	7.7	Explain effects of concentration, temperature and surface area on reaction rates.
	7.8	Describe the role of the rate constant in the theoretical determination of reaction rate.
8- THERMOCHEMISTRY & ENERGETICS OF CHEMICAL REACTIONS	8.1	Define thermodynamics.
	8.2	Classify reactions as exothermic or endothermic.
	8.3	Define the terms system, surrounding, boundary, state function, heat, heat capacity, internal energy, work done and enthalpy of a substance.
	8.4	Name and define the units of thermal energy.
	8.5	Explain the first law of thermodynamics for energy conservation.
	8.6	Apply Hess's Law to construct simple energy cycles.
	8.7	Describe enthalpy of a reaction.
9- ELECTROCHEMISTRY	9.1	Give the characteristics of a redox reaction.

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	9.2	Define oxidation and reduction in terms of a change in oxidation number.
	9.3	Use the oxidation-number change method to identify atoms being oxidized and reduced in redox reactions.
	9.4	Define cathode, anode, electrode potential and S.H.E (Standard Hydrogen Electrode).
	9.5	Use the ion-electron method/oxidation number method to balance chemical equations.
10- CHEMICAL BONDING	10.1	Use VSEPR theory to describe the shapes of molecules.
	10.2	Describe the features of sigma and pi bonds.
	10.3	Describe the shapes of simple molecules using orbital hybridization.
	10.4	Determine the shapes of some molecules from the number of bonded pairs and
	10.5	Predict the molecular polarity from the shapes of molecules.
	10.6	Explain what is meant by the term ionic character of a covalent bond.
	10.7	Describe how knowledge of molecular polarity can be used to explain some physical and chemical properties of molecules.
	10.8	Define bond energies and explain how they can be used to compare bond strengths of different chemical bonds.
	10.9	Define and explain the terms atomic radii, ionic radii, covalent radii, ionization energy, electron affinity, electro negativity, bond energy and bond length.
11- S AND P BLOCK ELEMENTS	11.1	Recognize the demarcation of the periodic table into s block, p block, d block, and f block.
	11.2	Describe how physical properties like atomic radius, ionization energy, electro negativity, electrical conductivity and melting and boiling points of elements change within a group and within a period in the periodic table.
	11.3	Describe reactions of Group I elements with water, oxygen and chlorine.
	11.4	Describe reactions of Group II elements with water, oxygen and nitrogen.
	11.5	Describe reactions of Group IV elements.
12- TRANSITION ELEMENTS		
13- FUNDAMENTAL PRINCIPLES OF ORGANIC CHEMISTRY	13.1	Define organic chemistry and organic compounds.
	13.2	Classify organic compounds on structural basis.
	13.3	Define functional group.
	13.4	Explain stereoisomerism and its types.
14- CHEMISTRY OF HYDROCARBONS	14.1	Classify hydrocarbons as aliphatic and aromatic.
	14.2	Describe nomenclature of alkanes.

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15- ALKYL HALIDES	14.3	Define free radical initiation, propagation and termination.
	14.4	Describe the mechanism of free radical substitution in alkanes exemplified by methane and ethane.
	14.5	Explain the IUPAC nomenclature of alkenes.
	14.6	Explain the shape of ethane molecule in terms of sigma and pi C-C bonds.
	14.7	Describe the structure and reactivity of alkenes as exemplified by ethane.
	14.8	Define and explain with suitable examples the terms isomerism and structural isomerism.
	14.9	Explain dehydration of alcohols and dehydrohalogenation of RX for the preparation of ethane.
	14.10	Describe the chemistry of alkenes by the following reactions of ethene: Hydrogenation, hydro halogenation, hydration, halogenation, halo hydration, polymerization.
	14.11	Explain the shape of the benzene molecule (molecular orbital treatment).
	14.12	Define resonance, resonance energy and relative stability.
	14.13	Compare the reactivity of benzene with alkanes and alkenes.
	14.14	Describe addition reactions of benzene and methylbenzene.
	14.15	Describe the mechanism of electrophilic substitution in benzene.
	14.16	Discuss chemistry of benzene and methylbenzene by nitration, sulphonation, halogenation, Friedal Craft's alkylation and acylation.
	14.17	Apply the knowledge of positions of substituents in the electrophilic substitution of benzene.
	14.18	Use the IUPAC naming system for alkynes.
	14.19	Compare the reactivity of alkynes with alkanes, alkenes and arenes.
	14.20	Describe the preparation of alkynes using elimination reactions.
	14.21	Describe acidity of alkynes.
	14.22	Discuss chemistry of alkynes by hydrogenation, hydro halogenation, and hydration.
	14.23	Describe and differentiate between substitution and addition reactions.
	15.1	Name alkyl halides using IUPAC system.
	15.2	Discuss the structure and reactivity of RX.
	15.3	Describe the mechanism and types of nucleophilic substitution reactions.
	15.4	Describe the mechanism and types of elimination reactions.

16- ALCOHOLS AND PHENOLS	16.1	Explain nomenclature and structure of alcohols.
	16.2	Explain the reactivity of alcohols.
	16.3	Describe the chemistry of alcohols by preparation of ethers and esters.
	16.4	Explain the nomenclature and structure of phenols.
	16.5	Discuss the reactivity of phenol and their chemistry by electrophilic aromatic substitution.
	16.6	Differentiate between an alcohol and phenol.
17- ALDEHYDES & KETONES	17.1	Explain nomenclature and structure of aldehydes and ketones.
	17.2	Discuss the preparation of aldehydes and ketones.
	17.3	Describe reactivity of aldehydes and ketones and their comparison.
	17.4	Describe acid and base catalyzed nucleophilic addition reactions of aldehydes and ketones.
	17.5	Discuss the chemistry of aldehydes and ketones by their reduction to alcohols.
	17.6	Describe oxidation reactions of aldehydes and ketones.
18- CARBOXYLIC ACIDS	18.1	Describe nomenclature, chemistry and preparation of carboxylic acids.
	18.2	Discuss reactivity of carboxylic acids.
	18.3	Describe the chemistry of carboxylic acids by conversion to carboxylic acid derivatives: acyl halides, anhydrides, esters, amides and reactions involving inter conversion of these.
19- MACRO MOLECULES	19.1	Explain the basis of classification and structure-function relationship of proteins.
	19.2	Describe the role of various proteins in maintaining body functions and their nutritional importance.
	19.3	Describe the role of enzymes as biocatalysts.

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# Physics

<b>UNIT</b>	<b>No.</b>	<b>STUDENT LEARNING OUTCOME</b>
1- FORCE AND MOTION	1.1	Describe displacement.
	1.2	Describe average velocity of objects.
	1.3	Interpret displacement-time graph of objects moving along the same straight line.
	1.4	Define uniform acceleration
	1.5	Distinguish between uniform and variable acceleration.
	1.6	Explain that projectile motion is two-dimensional motion in a vertical plane.
	1.7	Communicate the ideas of a projectile in the absence of air resistance.
	1.8	Explain Horizontal component (VH) of velocity is constant.
	1.9	Differentiate between the characteristics of horizontal motion and vertical motion
	1.10	Evaluate, using equations of uniformly accelerated motion for a given initial velocity of frictionless projectile, the following issues: a. How much higher does it go? b. How far would it go along the level land? c. Where would it be after a given time? d. How long will it remain in air? e. Launch angle that results in the maximum range f. Relation between the launch angles that result in the same range.
	1.11	Solve different problems of elastic and inelastic collisions between two bodies in one dimension by using law of conservation of momentum.
	1.12	Describe that momentum is conservational situations.
2- WORK AND ENERGY	1.13	Identify that for a perfectly elastic collision, the relative speed of approach is equal to the relative speed of separation.
	2.1	Describe the concept of work in terms of the product of force F and displacement d in the direction of force
	2.2	Define energy
	2.3	Explain kinetic energy
	2.4	Explain the difference between potential energy and gravitational potential energy.
	2.5	Describe that the gravitational potential energy is measured from a reference level and can be positive or negative, to denote the orientation from the reference levels.
	2.6	Express power as scalar product of force and velocity.
	2.7	Explain that work done against friction is dissipated as heat in the environment.
	2.8	State the implications of energy losses in practical devices

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3- ROTATIONAL AND CIRCULAR MOTION	3.1	Define angular displacement, express angular displacement in radians.
	3.2	Define revolution, degree and radian
	3.3	Define and Explain the term angular velocity
	3.4	Find out the relationship between the following: a. Relation between linear and angular variables b. Relation between linear and angular displacements c. Relation between linear and angular velocities d. Relation between linear and angular accelerations
4- WAVES	4.1	Describe the meaning of wave motion as illustrated by vibrations in ropes and springs.
	4.2	Demonstrate that mechanical waves require a medium for their propagation while electromagnetic waves do not.
	4.3	Define and apply the following terms to the wave model; medium, displacement, amplitude, period, compression, rarefaction, crest, trough, wavelength, velocity.
	4.4	Solve problems using the equation: $v = f\lambda$ .
	4.5	Explain that speed of sound depends on the properties of medium in which it propagates and describe Newton's formula of speed of waves.
	4.6	Describe the principle of super position of two waves from coherent sources.
	4.7	Describe the phenomenon of interference of sound waves.
	4.8	Explain the formation of stationary waves using graphical method
	4.9	Define the terms, node and antinodes.
	4.10	Describe modes of vibration of strings.
	4.11	Describe formation of stationary waves in vibrating air columns.
	4.12	Explain the principle of Superposition
	4.13	Explain S.H.M and explain the characteristics of S.H.M. ( <b>Chapter: Oscillation</b> )
5- THERMODYNAMICS	5.1	Describe that thermal energies transferred from a region of higher temperature to a region of lower temperature.
	5.2	Differentiate between specific heat and molar specific heat.
	5.3	Calculate work done by a thermodynamic system during a volume change.
	5.4	Describe the first law of thermodynamics expressed in terms of the change in internal energy, the heating of the system and work done on the system.
	5.5	Explain that first law of thermodynamics expresses the conservation of energy.
	5.6	Define the terms, specific heat and molar specific heats of a gas.

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6- ELECTROSTATICS	6.1	State Coulomb's law and explain that force between two-point charges is reduced in a medium other than free space using Coulomb's law
	6.2	Describe the concept of an electric field as an example of a field of force
	6.3	Calculate the magnitude and direction of the electric field at a point due to two charges with the same or opposite signs
	6.4	Sketch the electric field lines for two-point charges of equal magnitude with same or opposite signs
	6.5	Describe and draw the electric field due to an infinite size conducting plate of positive or negative charge
	6.6	Define electric potential at a point in terms of the work done in bringing unit positive charge from infinity to that point
	6.7	Define the unit of potential
	6.8	Derive an expression for electric potential at a point due to a point charge
	6.9	Demonstrate charging and discharging of a capacitor through a resistance
7- CURRENT ELECTRICITY	7.1	Describe the concept of steady current.
	7.2	State Ohm's law.
	7.3	Define resistivity and explain its dependence upon temperature.
	7.4	Explain the internal resistance of sources and its consequences for external circuits.
	7.5	Describe the conditions for maximum power transfer.
8- ELECTROMAGNETISM	8.1	Define magnetic flux density and its units.
	8.2	Describe the concept of magnetic flux ( $\emptyset$ ) as scalar product of magnetic field (B) and area (A) using the relation $\emptyset = B \perp A = B \cdot A$ .
	8.3	Describe quantitatively the path followed by a charged particle hot into a magnetic field in a direction perpendicular to the field.
	8.4	Explain that a force may act on a charged particle in a uniform magnetic field.
9- ELECTROMAGNETIC INDUCTION	9.1	State Faraday's law of electromagnetic induction.
	9.2	Account for Lenz's law to predict the direction of an induced current and relate to the principle of conservation of energy.
	9.3	Describe the construction of a transformer and explain how it works.
	9.4	Describe how set-up and step-down transformers can be used to ensure efficient transfer of electricity along cables.
10- ELECTRONICS	10.1	Define rectification and describe the use of diodes for half and full wave rectifications.
11- DAWN OF MODERN PHYSICS	11.1	Explain the particle model of light in terms of photons with particular energy
12- SPECTRA SPECTRA	12.1	Describe and explain Atomic spectra/ line spectrum

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13- NUCLEAR PHYSICS	13.1	Describe a simple model for the atom to include protons, neutrons and electrons
	13.2	Identify the spontaneous and random nature of nuclear decay.
	13.3	Describe the term half-life and solve problems using the equation $\lambda = \frac{0.693}{T_{\frac{1}{2}}}$ .
	13.4	Describe biological effects of radiation state and explain the different medical uses of radiation.



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## ENGLISH

LEARNING OBJECTIVES	BENCHMARKS
1. Comprehend key vocabulary	1.1 contextual clues and illustrations 1.2 background or prior knowledge 1.3 morphology, syntax, phonics, knowledge of word relationships 1.4 knowledge of synonyms, antonyms, homophones
2. Demonstrate control of tenses and sentence structure	2.1 Use correct tenses and sentence structure in writing 2.2 Identify mistakes in the use of tenses and sentence structure in written texts (implicitly)
3. Demonstrate ability to differentiate between correct and incorrect structure of sentences & Use of writing conventions of spelling, capitalization and Punctuation	3.1 Identify sentences with correct grammatical and style structures 3.2 Identify sentences with incorrect grammatical and style structures 3.3 Identify Use inappropriate capitalization and punctuation such as semi colons, commas in a series, apostrophes in possessives, proper nouns, and abbreviations
4. Demonstrate correct use of subject-verb agreement & of articles and prepositions	4.1 Use correct subject-verb agreement in written texts 4.2 Identify mistakes in the use of subject verb- agreement in written texts (implicitly) 4.3 Use appropriate articles and prepositions in different written contexts 4.4 Identify mistakes in the use of articles and prepositions in sentences or short texts 4.5 Select the appropriate article or preposition for a particular context
5. Demonstrate ability to identify mistakes in sentences or short written texts. These errors could be of inappropriate word order, vocabulary etc.	5.1 Identify errors of word order, style, vocabulary etc. in sentences
6. Demonstrate ability to comprehend short written text and select the most appropriate responses	6.1 Comprehend simple, brief passages 6.2 Select the most suitable responses to the questions posed (text- explicit)

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## LOGICAL REASONING

LEARNING OBJECTIVES	BENCHMARKS
5.1. Critical Thinking	Critical thinking is a process of evaluation which uses logic to separate truth from falsehood, reasonable from unreasonable beliefs
5.2. Letters & Symbol Series	Letter and Symbol Series are a sequential order of letters, numbers or both arranged such a way that each term in the series is obtained according to some specific rules. These rules can be based on mathematical operations, place of letters in alphabetical order etc.
5.3. Logical deductions	Logical reasoning is a type of thinking in which statements and relations between statements are used in a precise manner to make conclusions that are meant (or implied) by the statements and the relations. Logical deduction is a type of reasoning; it assesses a candidate's ability to use structured thinking to deduce from a short passage which of a number of statements is the most accurate response to a posed question.
5.4. Logical Problems	Logic problems are puzzles which require people to use deductive reasoning skills, meaning they need to look at different pieces of information in order to arrive at an answer.
5.5. Course of Action	A course of action is a step or administrative decision to be taken for improvement, follow-up or further action in regard to the problem, policy, etc. On the basis of the information given in the statement to be true, test-takers should decide which of the suggested courses of action logically follow(s) for pursuing.
5.6. Cause & Effect	Cause and effect is the relationship between two things when one thing makes something else happen. When examining events, people naturally seek to explain why things happened. This search often results in cause-and-effect reasoning, which asserts or denies that one thing causes another, or that one thing is caused by another.

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